

Silicates

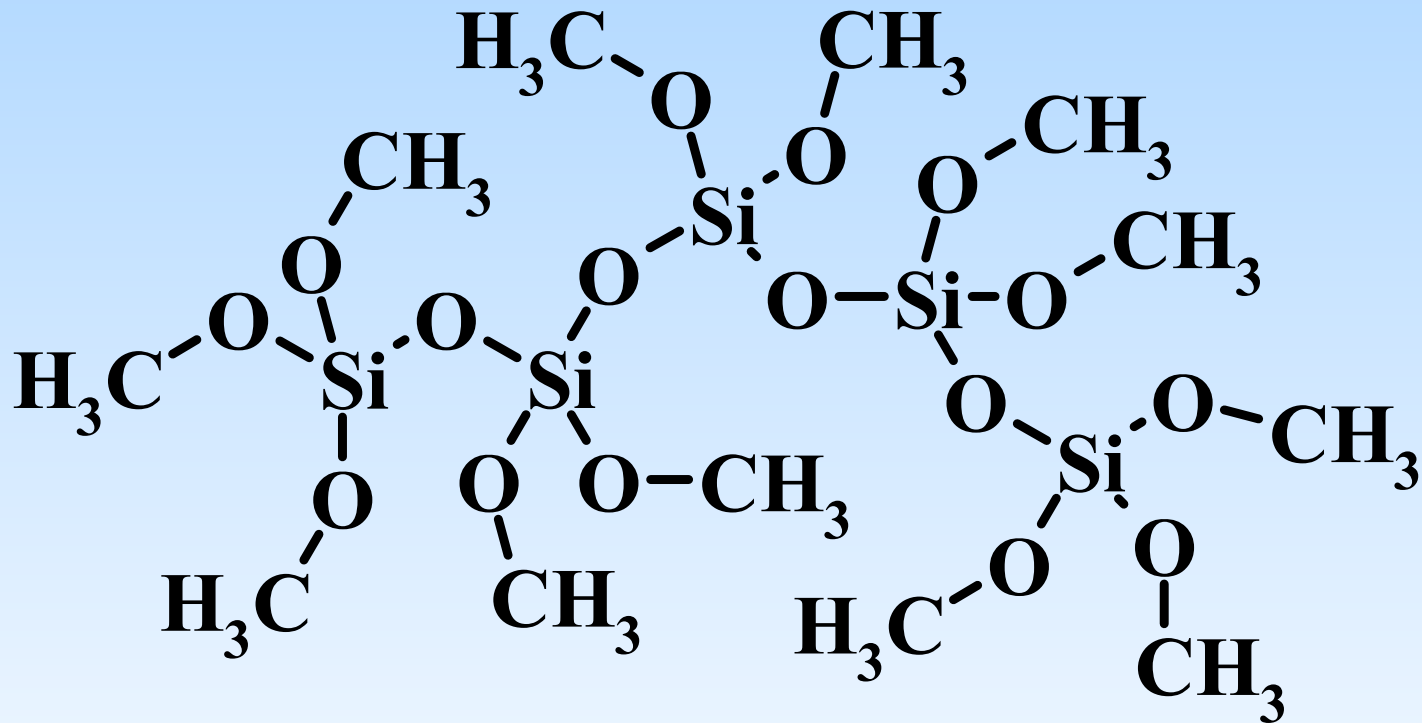
offered by

Mitsubishi International Corporation

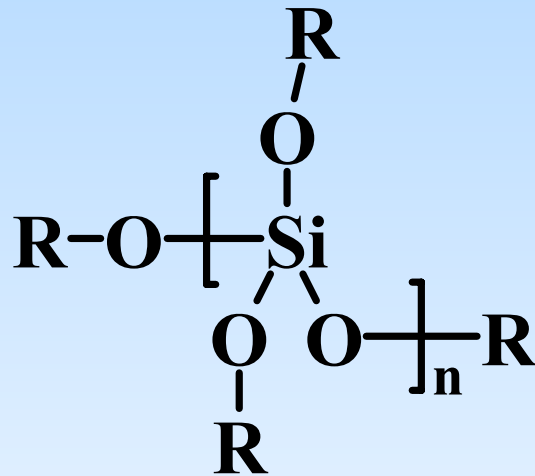
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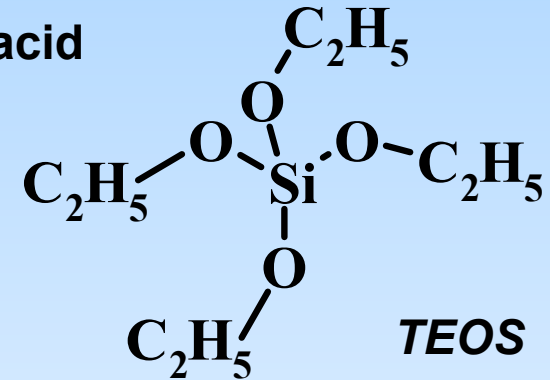
I. Chemical Structure of Silicate



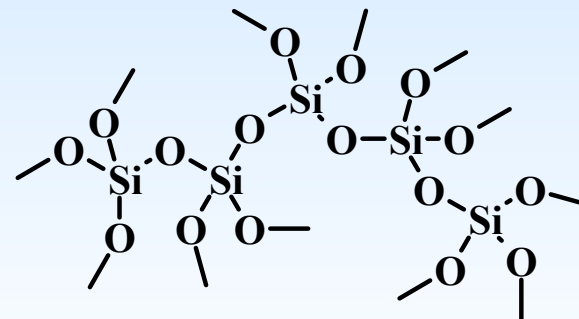
Chemical Structure of Silicate (2)



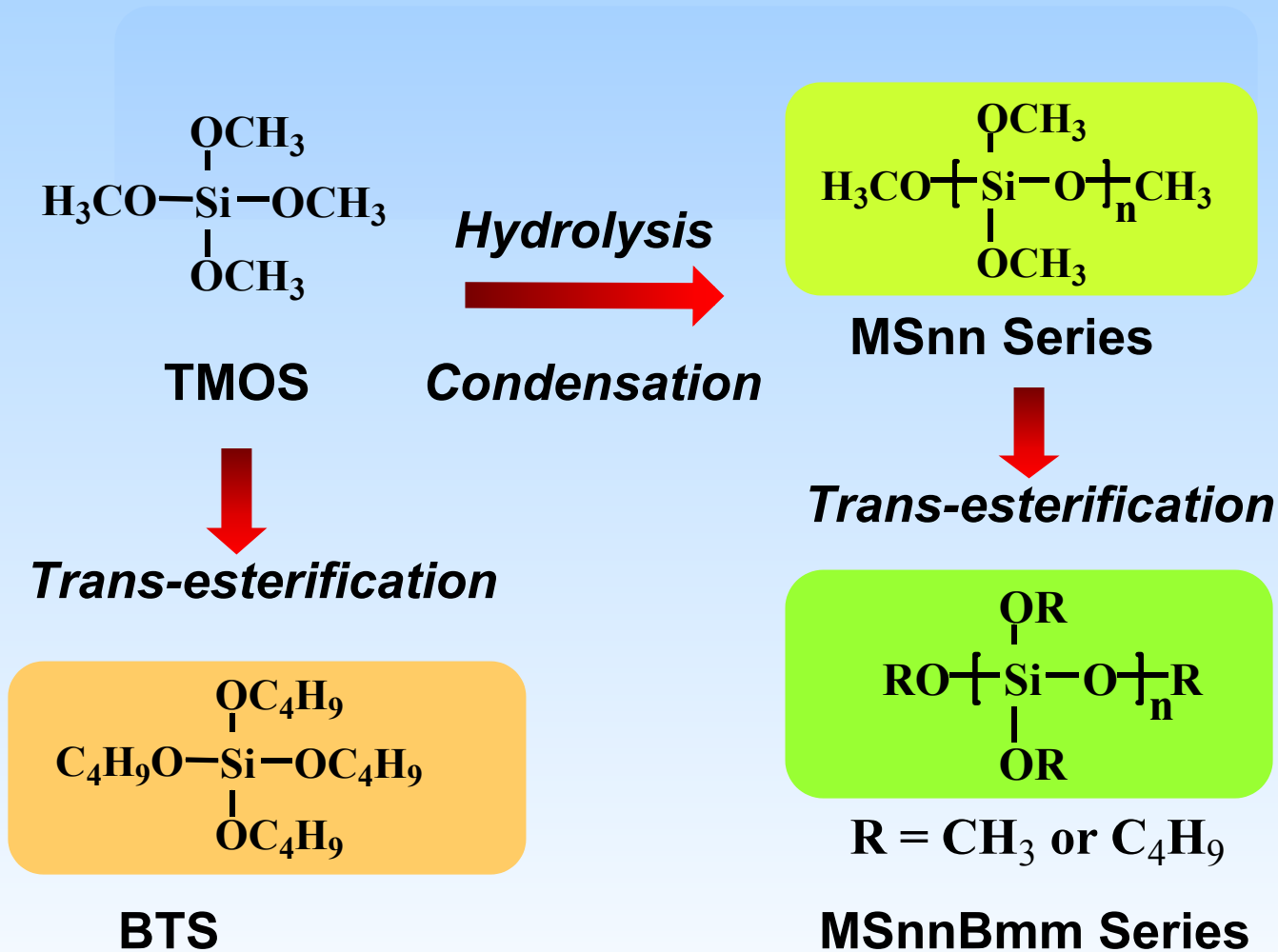
$n=1$: Ester of Orthosilicic acid



$n \geq 2$: Mixture of Polyalkoxy-polysiloxanes

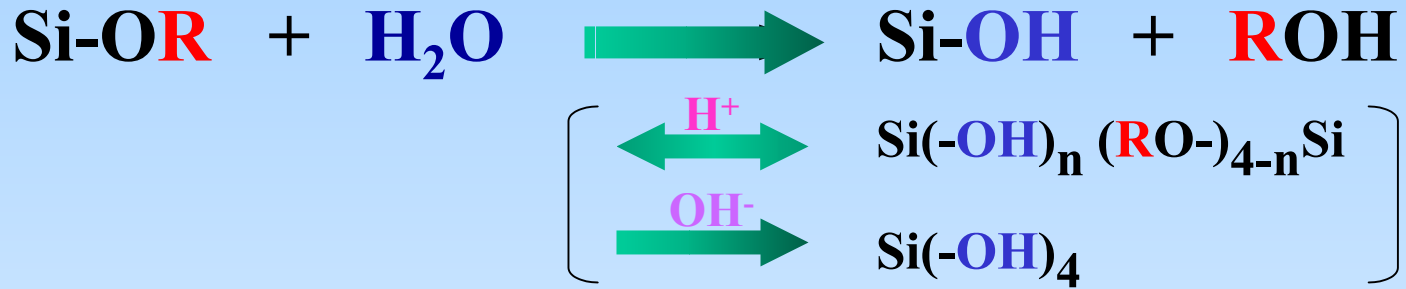


II. Structure of Silicates offered by MIC

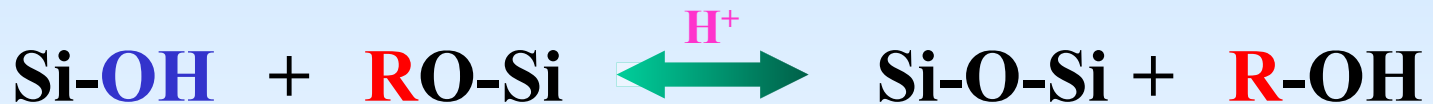


III. Chemical Reactions

- Hydrolysis



- Condensation (Chain extension/Gelation)



- Trans-esterification (Modification)



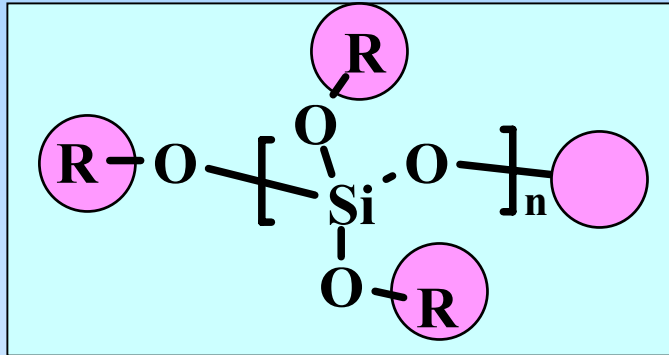
IV. Advantages of Silicate Products offered by MIC

- **Safety**
 - Very low TMOS content
 - High flash point
- **Variety**
 - Mw
 - Substituent
 - Hydrolysis degree
- **Reactivity**
 - Si-OH?
 - Relates to the MeO-Si functional group

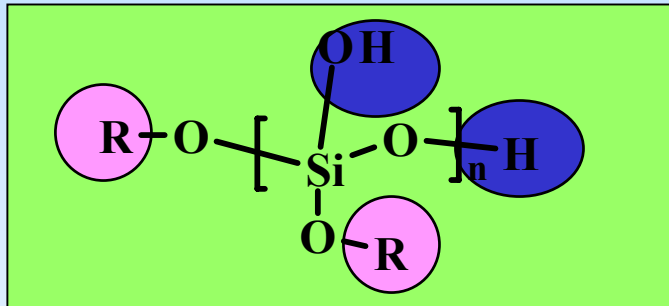
V. Properties of Methyl Silicates

Appearance: Colorless transparent liquid		Physical Properties		MS51	MS56	MS57	MS60
		Specific Gravity	G/cc	1.20±0.05	1.25± 0.05	1.26± 0.05	1.31± 0.10
Viscosity (25)	mP•s	4--10	15--45	30—90	100--1000		
Si Content as SiO ₂	Wt %	52.0± 1.0	56.5± 1.0	58.0± 1.0	60.0± 3.0		
Mw		500--700	1100--1300	1300--1500	2000-5000		
TMOS Content/ Cl Content	Wt %	<0.2 / <5	<0.2 / <5	<0.2 / <5	<0.2 / <5		
Boiling Point / Flash Point	ppm	>200 / 126.5	>200 / 152.0	>200 / 165.0	>200 / 176.0		
Solubility	Methanol	C	Sol.	Sol.	Sol.	Sol.	
	Acetone	C	Sol.	Sol.	Sol.	Sol.	
	Toluene		Sol.	Sol.	Sol.	Sol.	
	Terpene		Sol.	Sol.	Insol.	Insol.	

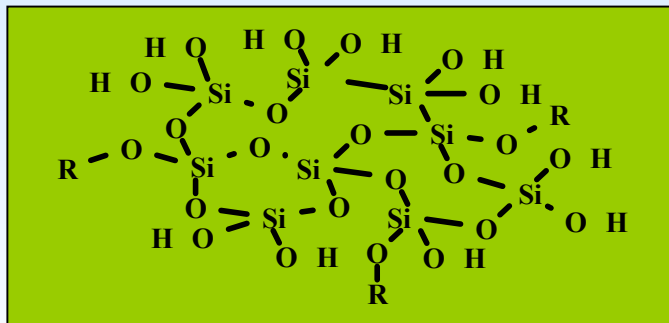
VI. Key Functions of Silicates



- Hydrophobic Function
 - Organic compatibility



- Hydrophilic Function
 - Water compatibility
 - Reactivity



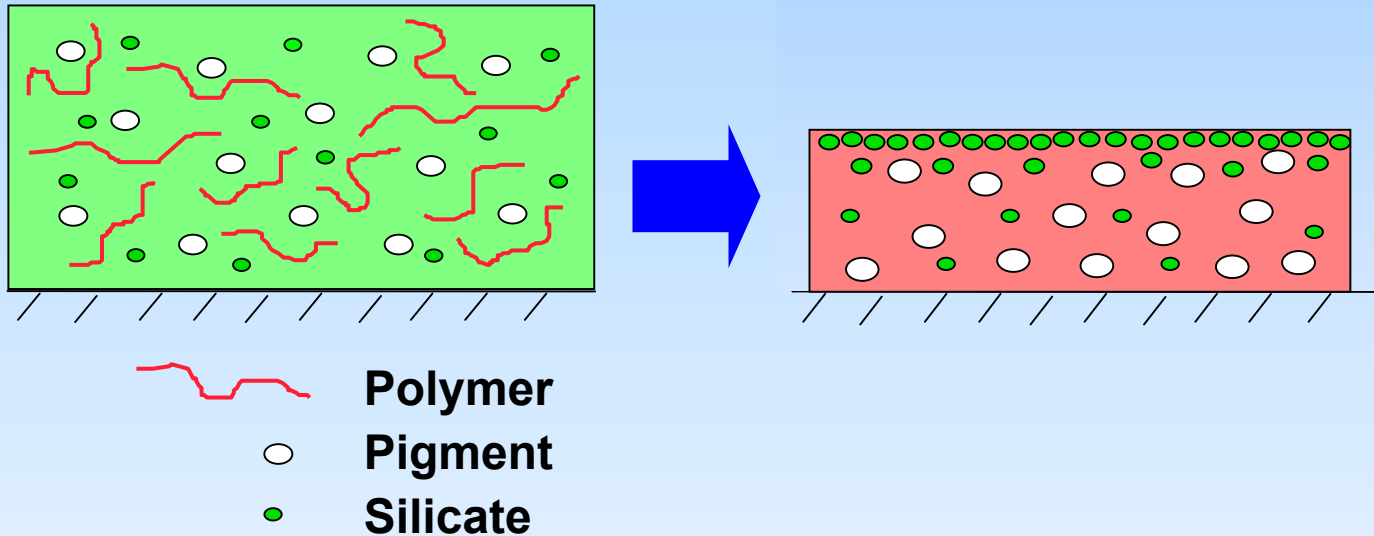
- Network Formation
 - Multifunctional/reactive
 - Crosslinked sol

VII. Basic Applications of Silicates

- **Hydrophobic Function**
 - Paint additives
 - Surface modification
 - Crosslinking agent
 - Organic/Inorganic hybrid
- **Network Formation**
 - Particles
 - Surface modification
- **Hydrophilic Function**
 - Coatings
 - Hardcoat binder
 - Heat resistivity
 - Non-flammability
 - Organic/Inorganic hybrid
 - Gas barrier

VIII. Coating Properties (1)

- Dirt shedding: Estimated reaction process



- Silicate migrates to the surface of coating as solvent evaporates based on hydrophilic/hydrophobic forces

IX. Other Coating Applications

- **Organic/Inorganic hybrid and Inorganic doping**
 - Silicates used as binders can control micro-environment
 - UV-absorbent
 - Laser dye
 - Photochromic dye
 - PHB compounds
- **Anti-fogging mirrors**
- **Top coat for films**
 - Adds hardness and scratch-resistibility
- **Paper-soaking**
 - Adds heat-resistivity
 - Reduces flammability

Next Steps

- Its high reactivity makes methyl silicate a very useful material
- MIC provides a product which delivers both high reactivity and chemical safety
- To learn more about how MIC can meet your product needs, please contact us at (212) 605-2440, or email rafi.khan@mitsubishicorp.com

Thank you.